PCT WORLD INTELLEC Inte

INTERNATIONAL APPLICATION PUBLISHEI

WO 9603721A1

(51) Internati nal Patent Classification 6 : G07F 15/06 A

(43) International Publication Date: 8 February 1996 (08.02.96)

(21) International Application Number: PCT/HU95/00037

(22) International Filing Date: 26 July 1995 (26.07.95)

(30) Priority Data:
P 94 02209 27 July 1994 (27.07.94) HU

(71) Applicant *(for all designated States except US)*: MAGYAR GÁZMÉRŐ TECHNIKA KFT. [HU/HU]; Király u. 2, H-8800 Nagykanizsa (HU).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: BÁTYI, Béla [HU/HU]; Szépvölgyi út 95, H-1037 Budapest (HU). BÍRÓ, Péter [HU/HU]; Ráth György u. 17/b, H-1122 Budapest (HU). VASANITS, Dezső [HU/HU]; Óbudai Gázgyár belső 1tp. VI/8. ép., H-1031 Budapest (HU). CSALLÓKÖZI, Zoltán [HU/HU]; Csörsz u. 57, H-1124 Budapest (HU).

(74) Agent: GÖDÖLLE, KÉKES, MÉSZÁROS & SZABÓ; Keleti Károly u. 13/b, H-1024 Budapest (HU).

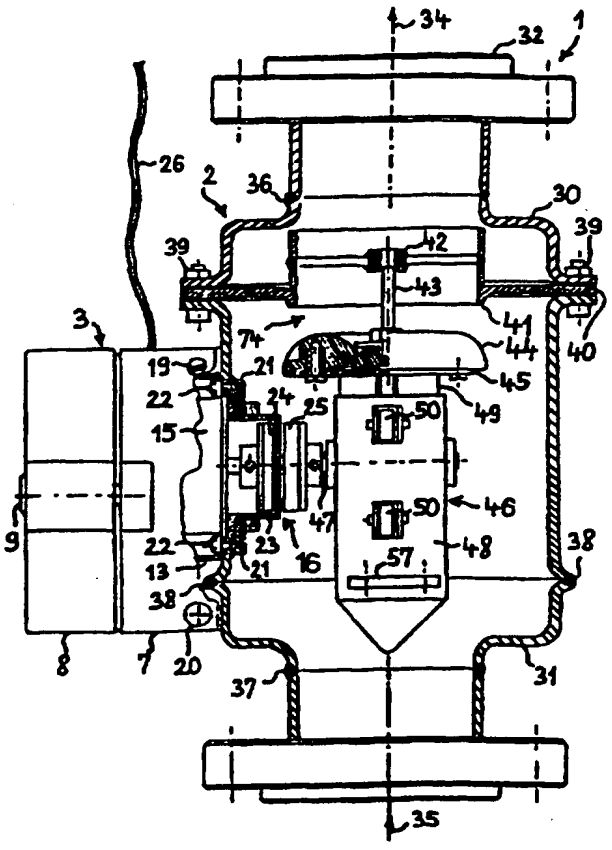
(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: APPARATUS FOR METERING AND DISPENSING GAS

(57) Abstract

An apparatus for metering and dispensing gas, comprising a shut-off device (2) for the gas to be consumed, means for receiving consumption signals corresponding to the gas consumption, a card reader (4) for reading data cards storing data corresponding to a predetermined quantity of gas and a control unit (62) having a microprocessor for controlling the shut-off device (2). According to the invention the shutt-off device (2) comprises a valve (74) to be inserted into a conduit of the gas, said valve (74) having a housing (17) and being actuated through a low friction moving mechanism (46) by a stepping motor (15), said stepping motor (15) being located outside the housing (17) of the valve (74), and there is a sealed magnetic coupling (16) to transfer rotation between the stepping motor (15) and the moving mechanism (46), said stepping motor (15) being controlled by the control unit (62) according to the gas consumption and to signals read from a data card.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**GB**	United Kingdom	**MR**	Mauritania
AU	Australia	**GE**	Georgia	**MW**	Malawi
BB	Barbados	**GN**	Guinea	**NE**	Niger
BE	Belgium	**GR**	Greece	**NL**	Netherlands
BF	Burkina Faso	**HU**	Hungary	**NO**	Norway
BG	Bulgaria	**IE**	Ireland	**NZ**	New Zealand
BJ	Benin	**IT**	Italy	**PL**	Poland
BR	Brazil	**JP**	Japan	**PT**	Portugal
BY	Belarus	**KE**	Kenya	**RO**	Romania
CA	Canada	**KG**	Kyrgystan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SI**	Slovenia
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SK**	Slovakia
CM	Cameroon	**LI**	Liechtenstein	**SN**	Senegal
CN	China	**LK**	Sri Lanka	**TD**	Chad
CS	Czechoslovakia	**LU**	Luxembourg	**TG**	Togo
CZ	Czech Republic	**LV**	Latvia	**TJ**	Tajikistan
DE	Germany	**MC**	Monaco	**TT**	Trinidad and Tobago
DK	Denmark	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**US**	United States of America
FI	Finland	**ML**	Mali	**UZ**	Uzbekistan
FR	France	**MN**	Mongolia	**VN**	Viet Nam
GA	Gabon				

Apparatus for metering and dispensing gas

TECHNICAL FIELD

The invention relates to an apparatus for metering and dispensing gas.

BACKGROUND ART

In conventional gas metering systems local consumption meters are checked in order to take readings at regular intervals by a person authorized to collect the charge. Bills corresponding to consumption are issued after taking the reading. This approach is labour intensive, requires accurate records and is subject to errors in taking the reading and also in further handling of the data. Consumption always precedes the taking of the reading and so the service provider gives a credit to the consumer.

Apparatus to allow the consumption only after the payment of the charge have been known for a long time. Gas meters and electricity meters operated by coins or a special coin have already been used for utilities consumption. However, these types of meters have not become widely popular for industrial and household consumption, because collecting the coins is troublesome and abuse may not be prevented.

In U.S. Patent No. 4,838,404 a microcomputer system is described, which is operated by a token. Upon inserting a token power is supplied to a device, for example to a TV set, for a period corresponding to the token. The optical detector

of the apparatus, r c iving the token, is designed in a way that a token of predetermined shape and coding can be inserted into the device in any position.

In Hungarian Patent No. 191,762 an electronic consumption metering system was described, in which the utilities consumption is measured on site by counting the number of pulses proportional to the consumption, followed by forwarding the measuring results automatically to a data processing center at regular periods, for example every month, through a telecommunication system. In this way human reading can be absolutely omitted. For this system, however, the data network must be built for each individual consumption meter, which is extremely costly for example in the case of household consumption.

For metering of electricity consumption and for dispensing consumption against preliminary payment, electronic systems have been recommended whereby the consumer must purchase in advance a consumption data card or memory chip from the service provider. On the basis of the data stored on the data card, the apparatus enables the consumption of a specified quantity of energy. Such systems are described for example in the following patents: US 4,162,530, GB-A 2,096,370, GB-A 2,111,280, GB-A 2,128,792, EP-A3 0,092,436 and EP-A2 0,131,331. In th se systems, the auxiliary electric power necessary for operation is available, because electric consumption is measured. If, however, the task is to meter and dispense another utility, e.g. gas, the auxiliary electric power is not always available, and even if it is, the implementation of an electric link-up is troublesome and/or expensive. Furthermore, it is not advantageous if the consumption metering and dispensing of one utility becomes impossible in case another utility eventually breaks down. However, conventional electrically controlled shut-off devices, e.g. magnetic valves, consume a substantial rate of power, so that they cannot be operated from an electric battery for a long time.

DISCLOSURE OF THE INVENTION

It is an object of the present invention to establish an apparatus for metering and disp nsing gas with low el ctric power consumption which apparatus can be used with conv nti nal gas m ters in ord r to liminate r gular p rsonal inspection

and reading of the gas meters. It is a further object of the invention to provide such an apparatus which is easy to manufacture and handle.

Thus, the invention is an apparatus for metering and dispensing gas, comprising a shut-off device for the gas to be consumed, means for receiving consumption signals corresponding to the gas consumption, a card reader for reading data cards storing data corresponding to a predetermined quantity of gas and a control unit having a microprocessor for controlling the shut-off device. According to the invention the shut-off device comprises a valve to be inserted into a conduit of the gas, said valve having a housing and being actuated through a low friction moving mechanism by a stepping motor, said stepping motor being located outside the housing of the valve, and there is a sealed magnetic coupling to transfer rotation between the stepping motor and the moving mechanism, said stepping motor being controlled by the control unit according to the gas consumption and to signals read from a data card.

In the apparatus according to the invention the actuating mechanism for the valve ensures a low electric power consumption. Neither in the open position, nor in the closed one is there any power consumption for the actuating mechanism. Only the electronic control unit has a very low power consumption. Therefore, the apparatus according to the invention can be operated for a long time without any maintenance using batteries available from trade.

In an advantageous embodiment of the invention the moving mechanism comprises a first cam device for closing the valve and a second cam device for opening the valve, said first and second cam devices being fastened to a shaft running on ball bearings, said shaft being rotated by the stepping motor. This solution ensures reliable closing and opening of the valve with a low friction, therefore, the power requirement of the operation of the moving mechanism can be kept low.

Preferably, the moving mechanism further comprises a case fixed to the housing of the valve, a frame slidable mounted within the case, said frame being moved by th first and s cond cam d vic s, and the first and second cam d vic s comprise ball bearings as rollers, said ball bearings having shafts fix d to the frame. In this way while moving frictional forces ar very low.

In order to achieve a tight closing without considerable force, in an embodiment of the invention the valve comprises a valve seat fixed to the housing and a valve body fixed to the frame through a valve plate, said valve body being made of rubber and provided with air pockets.

In a further advantageous embodiment of the invention the control unit adds the quantity corresponding to the signals read from a data card by the card read r to a stored quantity available for consumption, reduces the stored quantity in accordance with the received consumption signals, and if the stored quantity decreases to zero, closes the valve and if the stored quantity is higher than zero, keeps the valve open or opens it. It is a benefit of the invention that the data card giving eligibility for consumption is available for reading both during and before/aft r consumption.

In order to inform the consumer, it is advisable that the apparatus according to the invention further comprises a pushbutton for enabling the card reader and a display connected to the control unit for indicating the amount of gas available for consumption and error messages corresponding to states of the control unit. The current amount of gas available for consumption is displayed for a short period upon actuating the pushbutton, and error messages eventually arising during operation appear also for a short period, e.g. for some seconds.

It is advantageous if the control unit only adds the quantity corresponding to the signals read from the data card to the stored quantity available for consumption if the increased quantity is lower than a predetermined limit value, otherwise no addition is carried out and a first error message is issued. This is so as it may not be desirable in some cases, e.g. with respect to increase of tariff rates, that the consumer is enabled to accumulate an excessively large consumption quantity in his apparatus.

In safety respect it is advisable for the control unit to turn off the valve and to issue a second error message if the value of gas consumption per unit of time is over a predetermined value. In this way, e.g. in the case of a high gas leakage, the apparatus automatically shuts off the gas.

A gas consumption system asy to handle can be establish d if the control unit has a data m mory for storing an apparatus id ntifi r for matching the apparatus and the applicable data card and a sequence number of th data card

read most recently, and that the control unit only adds the quantity corresponding to the signals read from the data card to the stored quantity available for consumption, if the apparatus identifier read from the data card corresponds to the stored apparatus identifier and its sequence number is higher than that of the data card read most recently. In this system, the gas company increases the data card's sequence number by one, each time the data card is "validated" against payment. Through the matching of the apparatus and the data card, the service provider receives information on the consumption of each consumer and security is also granted against any use of the data card at another consumer if it is lost or stolen.

It may happen that the consumer does not have a reserve data card and the quantity available for gas consumption runs out exactly at the time, e.g. in week-end or holiday period, when it is impossible to "validate" the data card. In such a case, again in accordance with the invention, by reuse of an already used data card it is possible to consume a predetermined quantity under credit on a one-time basis. To this end, in case the apparatus identifier read from the data card corresponds to the stored apparatus identifier and its sequence number is not higher than that of the data card read most recently, the control unit adds a constant quantity to the stored quantity available for consumption if the valve is closed and the data card of a sequence number not higher is read for the first time, otherwise no addition is made and a third error message is issued. Monitoring whether the reuse of a data card already used for such a reserve purpose happens for the first time prevents any abuse.

In a further useful embodiment of the invention the control unit is switched from a stand-by state to an active state upon reading a data card or upon receiving a consumption signal, in said active state the control unit processes the signals received and in predetermined cases controls the valve, then returns to the stand-by state. According to this embodiment the control unit is in a stand-by state in most of its operating period, and in the stand-by state its electric power consumption is very low, in fact only a fraction of that in the active state.

It is advisable that the control unit comprises software means for resetting the control unit from th activ state to the stand-by state. In this way, aft r each activation, having carried out the data handling and processing task, the control unit

is imm diately pushed into the stand-by state. This action results in a very low auxiliary electric power consumption.

The apparatus according to the invention can be implemented preferably so that the card reader, the pushbutton, the display and the control unit are located in a casing attached to the housing of the valve, said casing having a lockable door with sight glass. The apparatus according to the invention can be mounted on an incoming connection stub of a gas meter per se known, and the cable for electric consumption signals from the gas meter to the apparatus according to the invention is preferably guided in a cable tube.

In a system based on apparatus according to the invention, it is not necessary to take readings of gas meters located at consumers, and this is beneficial for both the service provider and the consumers. Registering gas consumption is also much more simple than in a conventional syst m. Furthermore, the service provider does not advance the cost of gas consumption which, on the one hand, encourages the consumer to exercise austerity in consumption and, on the other hand, reduces the number of debates about the price to be paid substantially and eliminates litigations due to price arrears.

BRIEF DESCRIPTION OF DRAWINGS

Furthermore, the invention will be described on the basis of advantageous embodiments depicted on the drawings, where

Fig. 1 is a front view of an embodiment of the apparatus according to the invention,

Fig. 2 is a side view and partly a sectional view of the embodiment according to Fig. 1,

Fig. 3 is an enlarged sectional view along line A-A of Fig. 1,

Fig. 4 is a front view of the moving mechanism of the shut-off device in the apparatus according to Fig. 2,

Fig. 5 is a sectional view along line B-B of Fig. 4,

Fig. 6 is a s cti nal view along lin C-C of Fig. 5,

Fig. 7 is a s ctional vi w along line D-D of Fig. 4,

Fig. 8 is a sectional view of a part of the valve of the apparatus according to Fig. 2 in open position,

Fig. 9 is a sectional view of a part of the valve of the apparatus according to Fig. 2 in a position where the valve is beginning to close,

Fig. 10 is a sectional view of a part of the valve of the apparatus according to Fig. 2 in a fully closed position,

Fig. 11 is a simplified electric block diagram of the apparatus according to the invention, and

Figs. 12A and 12B are flow diagrams depicting the operation of the apparatus according to the invention.

In the drawings, identical elements or those of identical functions are shown by same reference signs.

MODES FOR CARRYING OUT THE INVENTION

In Figs. 1, 2 and 3 an apparatus 1 designed according to the invention is shown which consists of a shut-off device 2 to be inserted into a gas conduit not shown and a measurement/evaluation unit 3 attached to the shut-off device 2. The shut-off device 2 comprises a valve 74 with a housing 17, two cover plates 30 and 31 fixed to the housing 17 by screw joints 39 and a welded joint 38, respectively, and two connection stubs 32 and 33 fixed to the cover plates 30 and 31 by welded joints 36 and 37, respectively. The gas enters the apparatus 1 in the direction of arrow 35 at the connection stub 33 and exits in the direction of arrow 34 at the connection stub 32. The connection stub 32 can preferably be mounted to an incoming connection stub of a gas meter per se known not shown in the drawings.

The measurement/evaluation unit 3 has a casing 7 with a door 8 connected by a hinge 29 and having a sight glass 10 and a lock 9. The unit 3 comprises a card reader 4 provided with a slot 27 for inserting and pulling a data card in the direction of arrow 28, a pushbutton 5, an alphanumeric display 6, an electric circuitry depicted in Fig. 11 and a battery compartment. The apparatus 1 has an electronic control unit 62 (Fig. 11) which receives electric signals corresponding to gas consumption from the gas meter via cable 26, preferably guided within a cable

tube. E.g. in the gas meter a r ed-contact transmits an electric impulse for every 0.1 or 1 m^3 of gas consumed.

The measurement/evaluation unit 3 has a mounting plate 12 fixed to the casing 7 by spacers 11 to hold the electric circuitry including a switching amplifier for a stepping motor 15, the latter being connected by a cable 14. The ground plate 12 also holds a shield 13 for the stepping motor 15. The casing 7 is attached to lugs 18 fixed to the housing 17 by screwed joints 19, one or more of them secured by lead seal 20. There is a space between the housing 17 and the ground plate 12.

In the wall of the housing 17 facing the measurement/evaluation unit 3 there is an opening for the stepping motor 15 and for a sealed magnetic coupling 16 to transfer rotational movement between the shaft of the stepping motor 15 and a driving shaft 47 of a moving mechanism 46 of the valve 74 (Fig. 2). In the opening there is a ring fastener 21 fixed to the housing 17. The stepping motor 15 and a non-ferromagnetic sealing wall portion 23 are clamped to the ring fastener 21 by screws 22. The magnetic coupling 16 consists of two permanent magnetic discs 24 and 25. The wall portion 23, e.g. made of copper, and the magnetic coupling 16 ensure a separation of the electric parts from the inner gas space of the housing 17.

The moving mechanism 46, as shown in Figs. 4 to 7 in its position corresponding to a closed position of the valve 74, is designed for a lin ar movement of a valve body 44 (Fig. 2) with a minimum friction during operation. The mechanism 46 has a case 48, fastened by lugs 57 to the housing 17, with fixed ball bearings 75 and 76 for the driving shaft 47. Within the case 48 there is a slidable frame 49 guided by ball bearings 50 fixed also to the case 48. There are three cams 51, 52 and 53 fixed to the driving shaft 47 with corresponding rollers 54, 55 and 56, respectively, the latter being implemented by ball bearings. The cam 51 and the roller 54 form a cam device for closing the valve 74 (Fig. 2), while the cams 52 and 53 and the rollers 55 and 56, respectively, form another cam device for opening the valve 74. The shafts of the rollers 54, 55 and 56 are fixed to the frame 49. For opening and for closing the shaft 47 has to turn of by 360°. Th xtrem positions are determined by th cam 51 or the cams 52, 53 acting for the other direction of movement. Th re is a valve plate 45 with a rod 43 at ne end of the frame 49, said valve plate 45 having hol s 58 for fixing th valv body 44.

In Figs. 8 to 10 th valve 74 is shown in open, half closed and closed position, respectively. There is a valve seat 41 formed in a plate 40 fastened to the housing 17 by the screw joints 39. A guiding member 42 is attached to the valve seat 41 for guiding the rod 43 attached to the valve plate 45. The valve body 44 is made of a pentane-proof rubber with air pockets 77 in order to ensure a tight close even with lower force between the valve body 44 and the valve seat 41. The valve body 44 is fixed to the valve plate 45 by a washer 60 and a nut 61 and by screws 59 fitting into the holes 58 of the valve plate 45.

In Fig. 11 a block diagram shows connections between the digital control unit 62 and other units of the apparatus 1. The control unit 62 includes a microprocessor and preferably can be implemented by a CMOS microcontroller of type PIC16C5x of Microchip Technology, Inc., Chandler, Arizona, U.S.A. The pushbutton 5 and the pulse transmitter 64 of the gas meter are connected to the control unit 62 through signal conditioners 63 and 65, respectively. The card reader 4 suitable for reading a data card 66 with a magnetic stripe 67 is also connected to the control unit 62. However, the data card to be used with the present invention can be of any type suitable for storing digital data, such as any other magnetic card or an optical card. Preferably, use may also be made of an active memory card. In the embodiment described the control unit 62 must be enabled by pressing the pushbutton 5 prior to reading the data card 66, said pressing leading the control unit 62 being switched from a stand-by ("sleeping") state to an active state, and then the data card 66 is to be pulled along the slot 27 in the direction of arrow 28 (Fig. 1). Another approach is also possible, whereby the enabling is carried out by simply inserting the data card 66 into the slot 27. The enabling of the control unit 62 occurs also by receiving a consumption pulse from the pulse transmitter 64 of the gas meter via cable 26. In the stand-by state only the most essential circuits, the internal RAM and some internal data registers as well as the display 6 and the digital clock 71 are supplied by power, and so the consumption is much lower (some μA) than in the active state (some mA). Having completed the operation, the software res ts th control unit 62 to its stand-by stat .

Th supply of the control unit 62 is ensured by a power supply 69 fed by a batt ry 68 which is .g. a long life alkali batt ry. The alphanumeric display 6 is conn cted to th control unit 62 through a driv r 70. A real tim digital clock 71 is

also conn cted to the control unit 62. The stepping motor 15 is driven by a switching amplifier 72 known per se having own supply by a long life battery 73. It is possible that the control unit 62 receives further emergency input signals emitted by transmitters not shown, e.g. overtemperature and magnetic field sensors, and an electric circuit detecting damage or cutoff in the cable 26 connecting the apparatus 1 with the gas meter.

The operation of the apparatus as per Fig. 11 is depicted on the basis of the flow diagram shown in Figs. 12A and 12B. When Figs. 12A and 12B are plac d side by side, they make up one complete figure. If the control unit 62 of the apparatus is in START state 79, i.e. it can be triggered, upon start-up 78 it switches from stand-by state to active state in step 80, and the program is launched. In steps 81 and 93, the control unit 62 examines what caused the start-up 78. The start-up 78 can be caused by the arrival of a consumption signal (pulse) via cable 26, by pressing of the pushbutton 5 prior to inserting and pulling of a data card 66, or by an emergency signal issued by a unit not shown in Fig. 11, for example by a magnetic field sensor to prevent stealing or a temperature sensor providing a signal at overtemperature.

If the start-up 78 was caused by a consumption signal, in step 82 the quantity corresponding to the consumption signal is deducted from the stored quantity still available, the real time rate T is read in from the digital clock 71 and operations T2 = T1 and T1 = T are carried out. The initial values of T2, T1 and T are zero. The period T1 - T2 identifies the time which has elapsed since the last consumption signal. In step 83 it is examined whether the duration of T1 - T2 is longer than a predetermined TM period. Since the consumption signal represents a predetermined consumption quantity, the period T1 - T2 is inversely proportional with the consumption per one unit of time. For a safety aspect, e.g. in order to prevent a high gas leakage, it is advisable to define a maximum value, e.g. double the nominal rate for consumption per one unit of time and to shut off the valve 74 above this rate in such a way that it can only be put into operation again by a mechanic. The period TM must be determined according to th p rmissible maximum rat . If the period T1 - T2 is not long r than period TM, the control unit 62 gen rat s an rror cod E4 in st p 88, turns ff valv 74 in st p 89, displays an error cod E4 n display 6 in st p 90 and then the control unit 62 is r s t in st p 91

in its stand-by state and simultaneously in the STOP state 92, from which only a special data card can bring it to the START state 79 again. Only an authorized person, e.g. a mechanic, is supplied with this special data card. The mechanic is able to check - with the special data card - the accumulated consumption, the number of shut-offs, the identifier of consumption and the particulars of the data card used most recently.

If the period T1 - T2 is longer than period TM, the apparatus tests in step 84 whether the still available quantity is higher than zero, i.e. whether consumption is still possible. If not, it closes valve 74 in step 85 and if it is higher, no shut-off takes place. Next, in step 86, the still available quantity or in the given case one of the error codes is displayed, and then in step 87 the control unit 62 is brought to stand-by state and into START state 79. The display 6 indicates the gas quantity still available for consumption in m^3.

If in step 93 the apparatus finds out that start-up 78 was caused by the pressing of the pushbutton 5, a pause of about 8 s is kept for the data card 66 to be inserted and pulled along. This operation is represented by a closed loop consisting of steps 94 and 101. If the data card 66 is not pulled along within this period, an error code EE is generated in step 106 and then the operation continues with step 86. If the data card 66 is pulled along within the given period, the identifier of the apparatus 1, the sequence number of the data card 66, the quantity represented by the data card 66 and the quantity still available for consumption stored by the control unit 62 is read in step 95. After this, in step 96, the apparatus examines whether the sequence number read is higher than the sequence number obtained upon reading of the previous data card. In this way it is prevented that someone makes use of a data card twice, without "validation", i.e. without the payment of the tariff. Upon the payment of the charge, the sequence number of the data card is increased by one. If the sequence number is not higher and the valve 74 is open (this will be described below in connection with step 102), the apparatus generates an error code E1 in step 107, and then the operation continues with step 86. If the sequence number is higher, the apparatus checks in step 97 whether the quantity represented by the data card 66 can be added to the stored quantity available for consumption, i.e. whether the quantities can be accumulated. For practical reasons, it is advisable to limit the quantity available for consumption. For example

if the average annual gas consumption of a hous hold is 1000 to 1500 m^3, the above limitation can be 2500 m^3 and the maximum of consumption quantity represented by one data card can be 1000 m^3. If the quantity resulting from accumulation exceeds this limit, the apparatus does not allow accumulation, generates an error code E2 in step 108 and then operation continues with step 86. The data card 66 may only be used if the stored quantity decreases so much that the result of the accumulation remains below the limitation above. If accumulation is permitted, the apparatus checks in step 98 whether the data card 66 is associated with the apparatus 1, i.e. whether the identifier read from the data card 66 is identical with the stored identifier of the apparatus 1. If not, an error code E3 is generated in step 109 and then operation continues with step 86. If they are identical, accumulation takes place in step 99 and the sequence number stored is rewritten by the sequence number of the data card 66. Next, in step 100 the apparatus examines whether the valve 74 is open. If not, it is opened in step 110, and then operation continues with step 86. If the valve 74 is open, the opening step 110 is omitted.

If the user has consumed the total quantity available, the apparatus 1 automatically shuts off. In this case it may happen that the user does not have a data card validated for further consumption and because of a week-end or holiday period he cannot validate his data card for a time. In order to make sure that no pause occurs in such cases in the use of equipments supplied by gas, it is advisable to allow the reuse of the most recently applied data card without validation, on a one time basis, for a "credited" consumption of reserve (e.g. a predetermined value in the range of 10-50 m^3). To this end, if the sequence number of the inserted data card 66 is not higher than that of the card used before, it is examined in steps 102 whether the valve 74 is closed. If it is open, there is no justification yet to allow the use of the reserve and the step 107 described above takes place. If it is closed, however, it will be examined in step 103 whether a first use of the reserve is now intended. If not, step 107 takes place. If there is a first use of the reserve, the apparatus checks wh th r the id ntifier read from the data card is th sam as the identifier of the apparatus 1. If not, step 109 above follows. If it is th same, in st p 105 th reserve quantity is added (accumulation) and the

fact of using the res rve is written in. Then, operation continues in step 110 with the opening of valve 74.

If in step 93 it is found out that start-up 78 was not caused by pressing of the pushbutton 5, the only case remaining is when start-up 78 has been caused by a kind of emergency signal. Such an emergency signal may be generated for example when someone cuts off the cable 26, or attempts to manipulate the gas meter or the apparatus 1 by strong external magnetic field. To prevent this manipulation, at an appropriate place a magnetic field sensor, e.g. a reed contact or a Hall-probe, is located which communicates with the control unit 62. A temperature sensor triggered at overtemperature, e.g. in the case of fire, may also emit emergency signal. Upon an emergency alarm, in step 111 an error code E5 is generated and operation continues in step 89 with the closing of valve 74.

In one embodiment of the gas metering and dispensing apparatus according to the invention, the durations of active states of the control unit 62 in the most unfavourable case are the following: 5 s when pressing the pushbutton 5, 2 s after starting the insertion of a data card 66, 4 s upon opening or closing the valve 74, and 0.025 s when a consumption pulse corresponding to 1 m^3 arrives. Therefore, 50 openings and 50 closings on an annual average result in 50 . (5+2+4+4) = 750 s, and an annual consumption of 2000 m^3 entails 2000 . 0.025 = 50 s, that is a total of 800 s $\approx$ 0.22 h active duration per annum. This total active period has a ratio to the total annual stand-by period as approximately 1 to 40,000.

With alkali batteries available from trade currently, having a guaranteed lifetime of ten years, the embodiment of the apparatus described above can be operated at least 2000 times. This means that for a period of ten years on an average one operation can take place approximately every two days (reading in of data card, closing etc.). Preferably, the time period shall be selected according to the time period in which the gas meters must be calibrated.

It is evident for those skilled in the art that the above disclosures are xemplary only and that various other embodiments of the invention may be made or us d within th scope of the pres nt invention as d fined by th following claims.

CLAIMS

1. An apparatus for metering and dispensing gas, comprising a shut-off device for the gas to be consumed, means for receiving consumption signals corresponding to the gas consumption, a card reader for reading data cards storing data corresponding to a predetermined quantity of gas and a control unit having a microprocessor for controlling the shut-off device, c h a r a c t e r i z e d in that the shut-off device (2) comprises a valve (74) to be inserted into a conduit of the gas, said valve (74) having a housing (17) and being actuated through a low friction moving mechanism (46) by a stepping motor (15), said stepping motor (15) being located outside the housing (17) of the valve (74), and there is a sealed magn tic coupling (16) to transfer rotation between the stepping motor (15) and the moving mechanism (46), said stepping motor (15) being controlled by the control unit (62) according to the gas consumption and to signals read from a data card.

2. The apparatus according to claim 1, characterized in that the moving mechanism (46) comprises a first cam device (51, 54) for closing the valve (74) and a second cam device (52, 55; 53, 56) for opening the valve (74), said first and second cam devices (51, 54; 52, 55; 53, 56) being fastened to a shaft (47) running on ball bearings (75, 76), said shaft (47) being rotated by the stepping motor (15).

3. The apparatus according to claim 2, characterized, in that the moving mechanism (46) further comprises a case (48) fixed to the housing (17) of the valve (74), a frame (49) slidable mounted within the case (48), said frame (49) being moved by the first and second cam devices (51, 54; 52, 55; 53, 56).

4. The apparatus according to claim 3, characterized in that the first and second cam devices (51, 54; 52, 55; 53, 56) comprise ball bearings as rollers (54; 55; 56), said ball bearings having shafts fixed to the frame (49).

5. The apparatus according to any of claims 2 to 4, characterized in that the valve (74) comprises a valve seat (41) fixed to the housing (17) and a valve body (44) fixed to the frame (49) through a valv plate (45), said valve b dy (44) being made of rubb r and provided with air pock ts (77).

6. The apparatus according to claim 1, characteriz d in that th control unit (62) adds th quantity corresponding to th signals read from a data card by the

card reader (4) to a stor d quantity available for consumption, reduces the stored quantity in accordance with the received consumption signals, and if the stored quantity decreases to zero, closes the valve (74) and if the stored quantity is higher than zero, keeps the valve (74) open or opens it.

7. The apparatus according to claim 6, characterized by further comprising a pushbutton (5) for enabling the card reader (4) and a display (6) connected to the control unit (62) for indicating the amount of gas available for consumption and error messages corresponding to states of the control unit (62).

8. The apparatus according to claim 7, characterized in that the control unit (62) only adds the quantity corresponding to the signals read from the data card to the stored quantity available for consumption if the increased quantity is lower than a predetermined limit value, otherwise no addition is carried out and a first error message is issued.

9. The apparatus according to claim 7 or claim 8, characterized in that the control unit (62) turns off the valve (74) and issues a second error message if the value of consumption per unit of time is over a predetermined value.

10. The apparatus according to claim 7, characterized in that the control unit (62) has a data memory for storing an apparatus identifier for matching the apparatus and the applicable data card and a sequence number of the data card read most recently, and that the control unit (62) only adds the quantity corresponding to the signals read from the data card to the stored quantity available for consumption, if the apparatus identifier read from the data card corresponds to the stored apparatus identifier and its sequence number is higher than that of the data card read most recently.

11. The apparatus according to claim 10, characterized in that in case the apparatus identifier read from the data card corresponds to the stored apparatus identifier and its sequence number is not higher than that of the data card read most recently, the control unit (62) adds a constant quantity to the stored quantity available for consumption if the valve (74) is closed and the data card of a s quence numb r not higher is r ad for the first time, oth rwise no addition is made and a third error message is issued.

12. The apparatus according to claim 1, charact rized in that the control unit (62) is switched from a stand-by stat to an activ state upon r ading a data card

or upon r c iving a consumption signal, in said active state the control unit (62) processes the signals received and in predetermined cases controls the valve (74), then returns to the stand-by state.

13. The apparatus according to claim 12, characterized in that the control unit (62) comprises software means for resetting the control unit (62) from the active state to the stand-by state.

14. The apparatus according to claim 7, characterized in that the card read r (4), the pushbutton (5), the display (6) and the control unit (62) are located in a casing (7) attached to the housing (17) of the valve (74), said casing (7) having a lockable door (8) with sight glass (10).

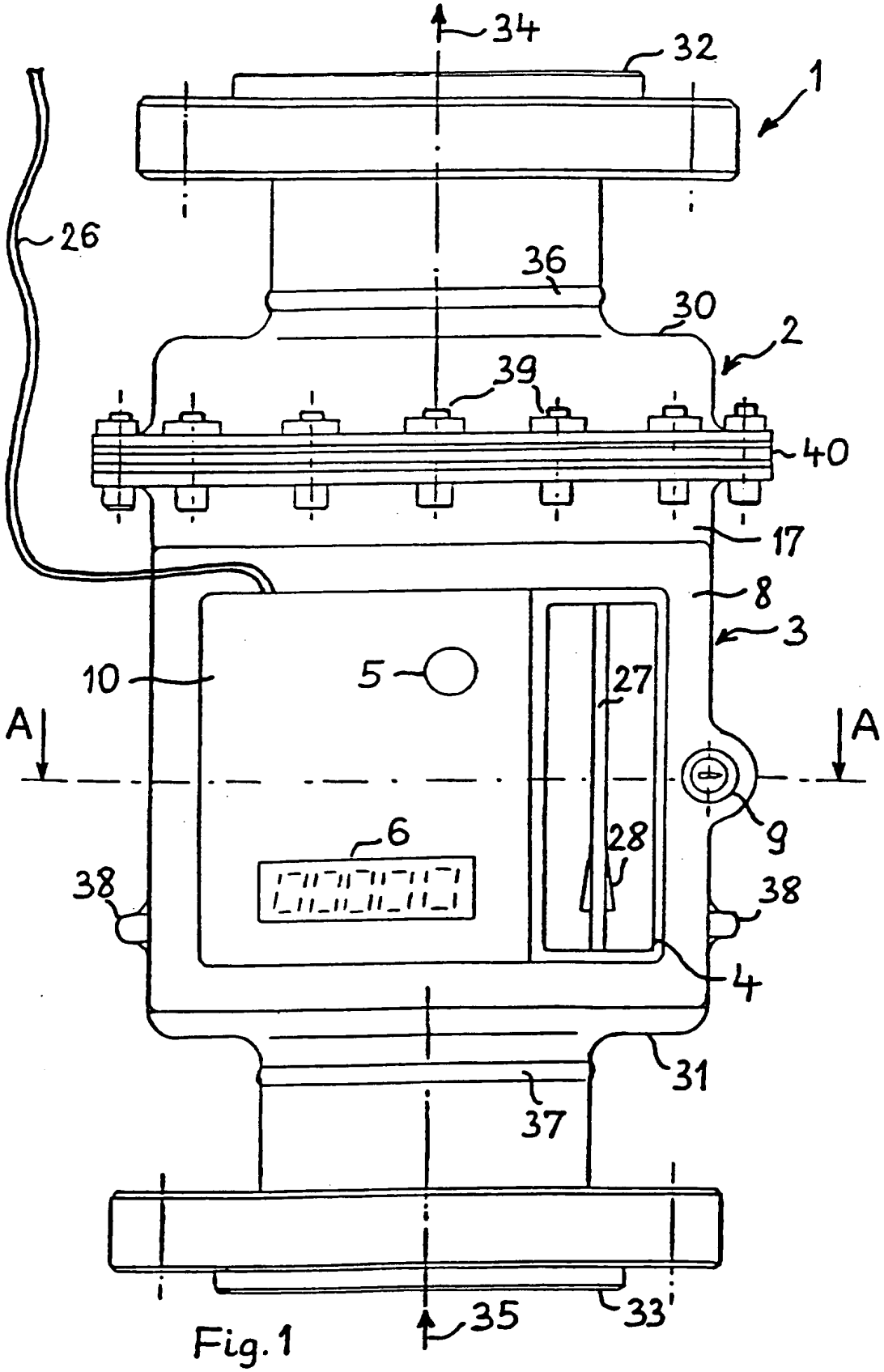


Fig. 1

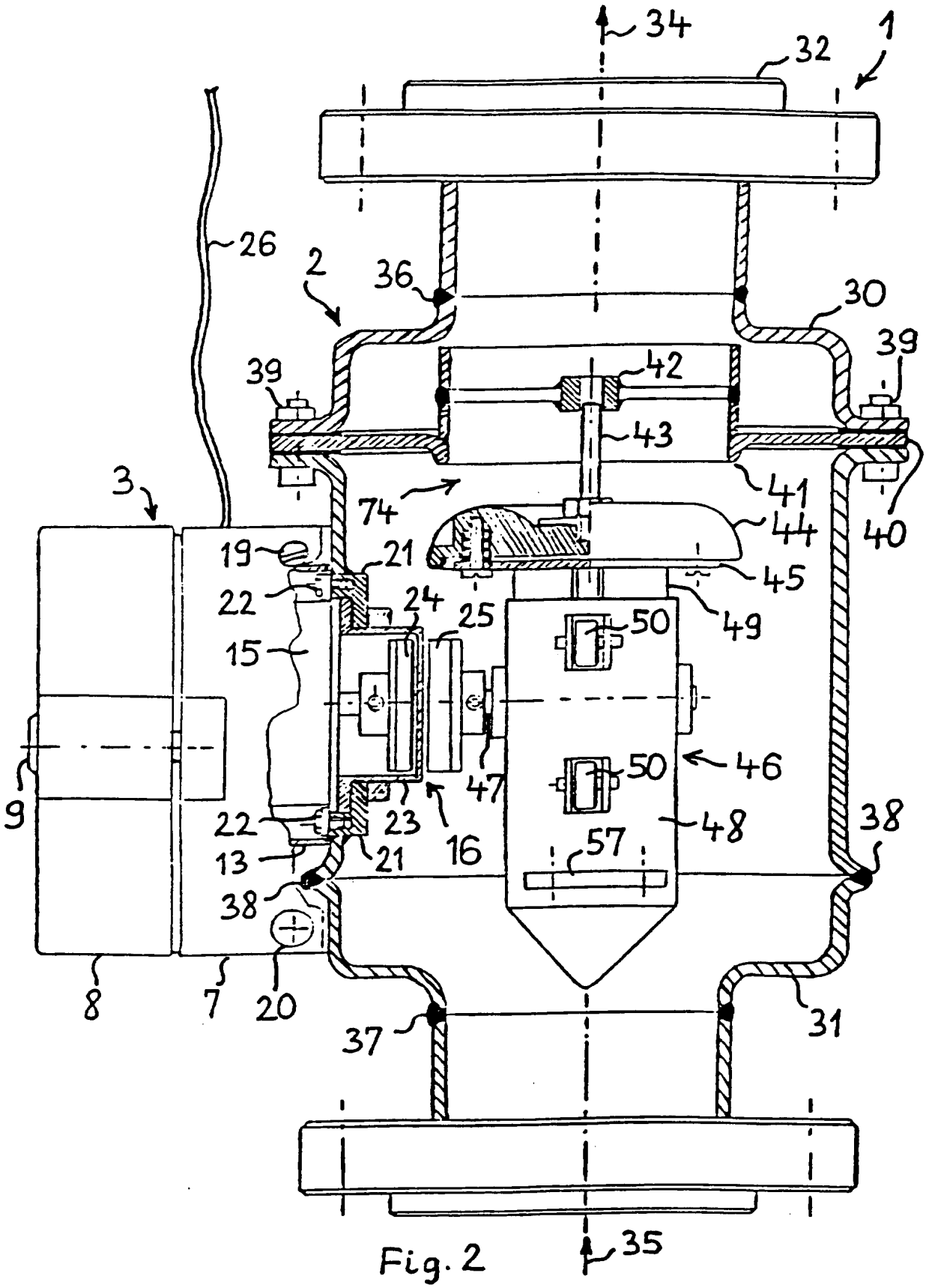


Fig. 2

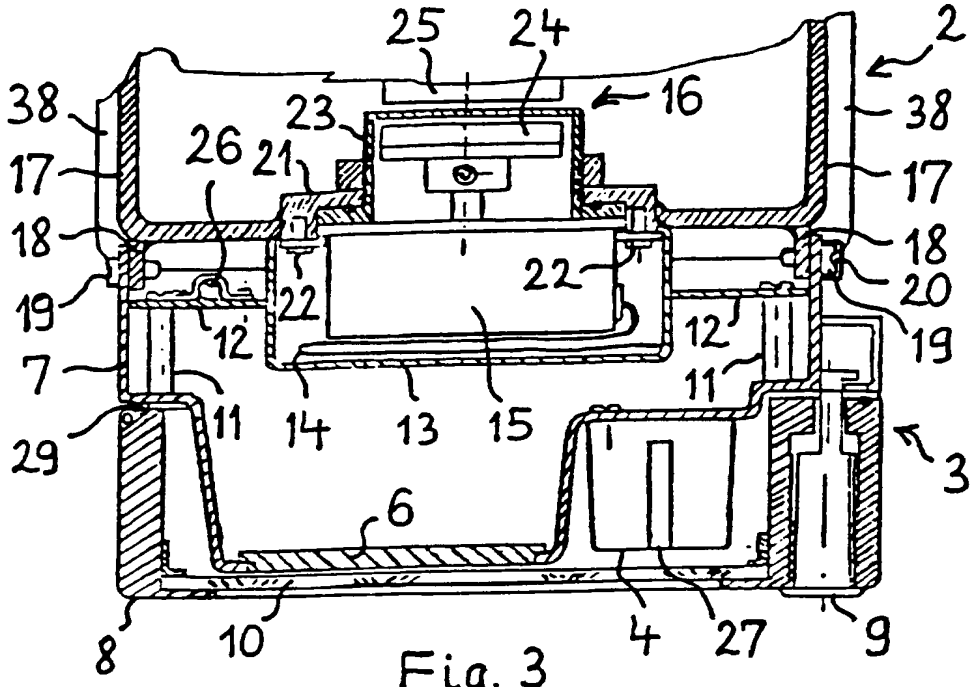


Fig. 3

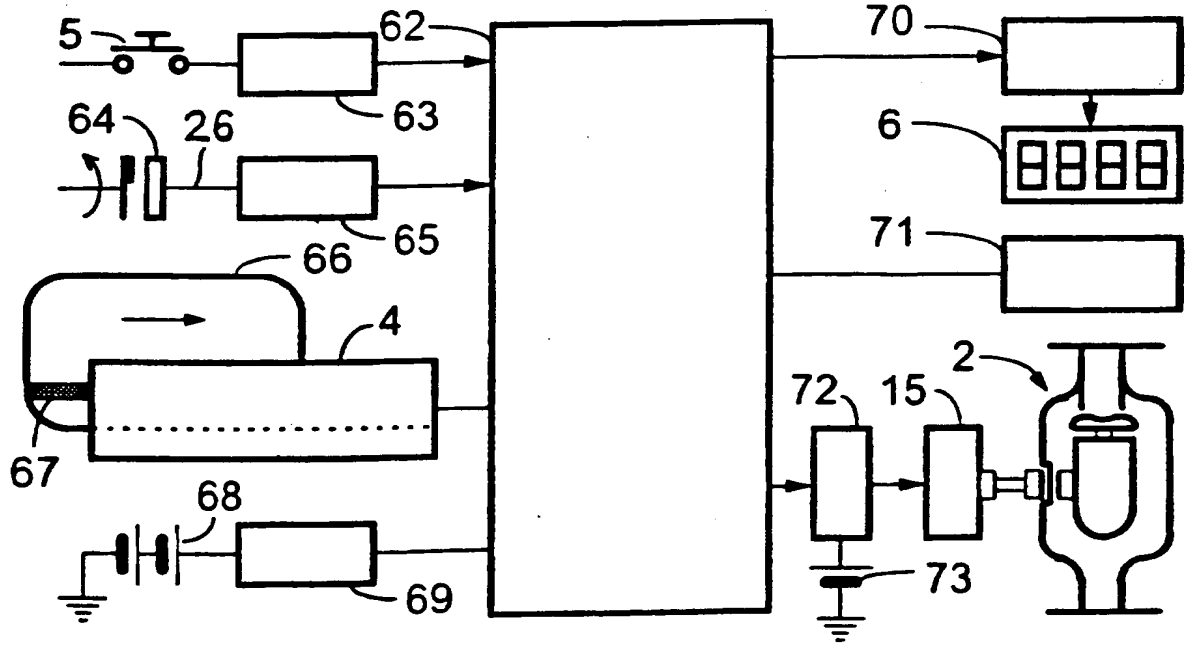


Fig. 11

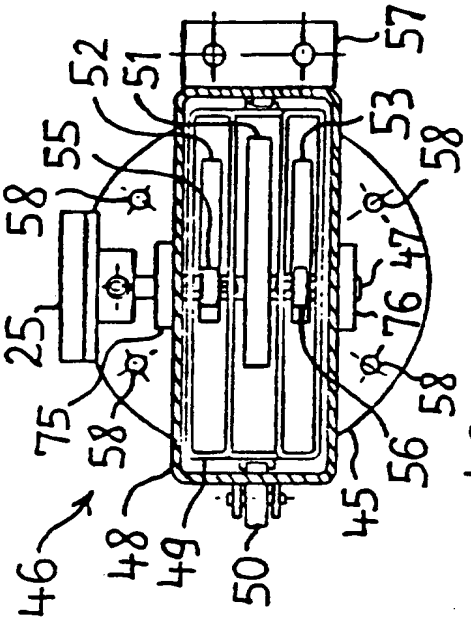


Fig. 7

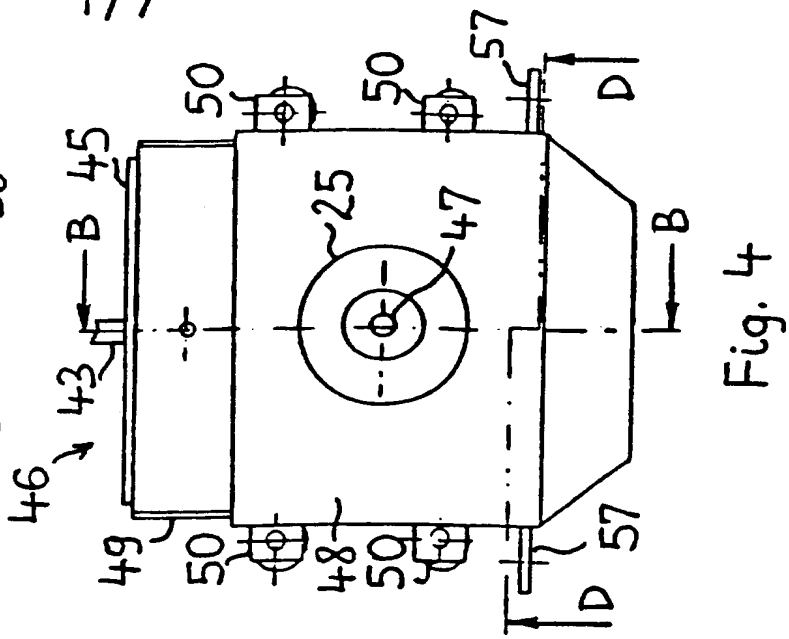


Fig. 4

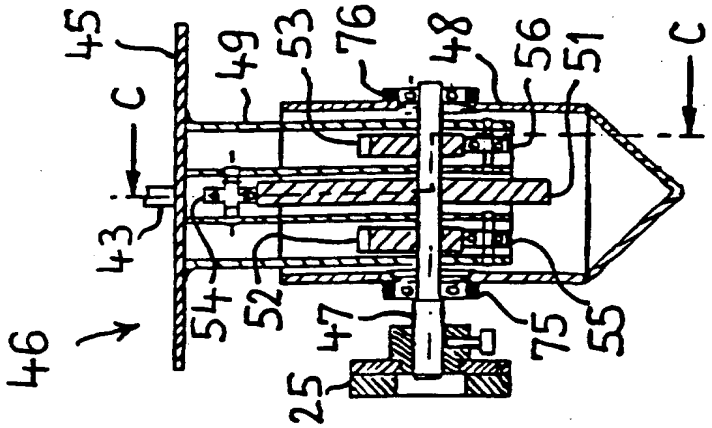


Fig. 5

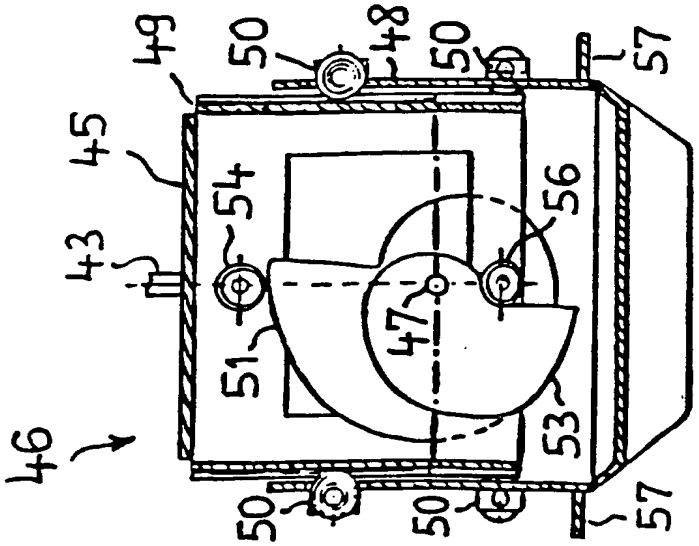


Fig. 6

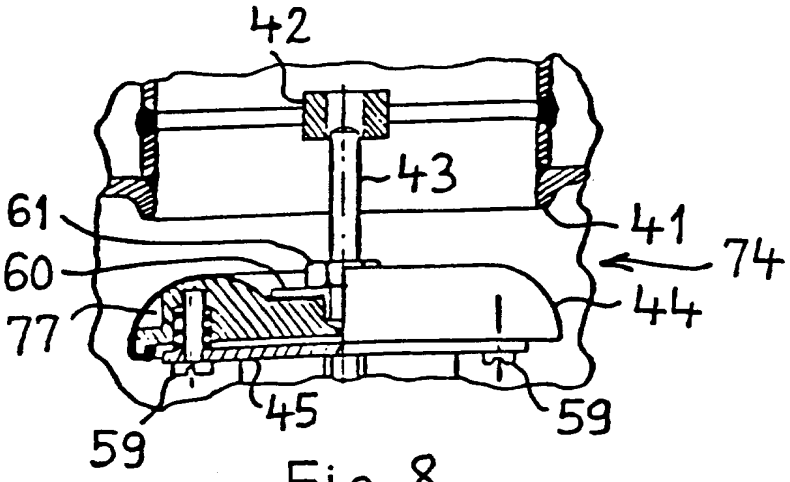


Fig. 8

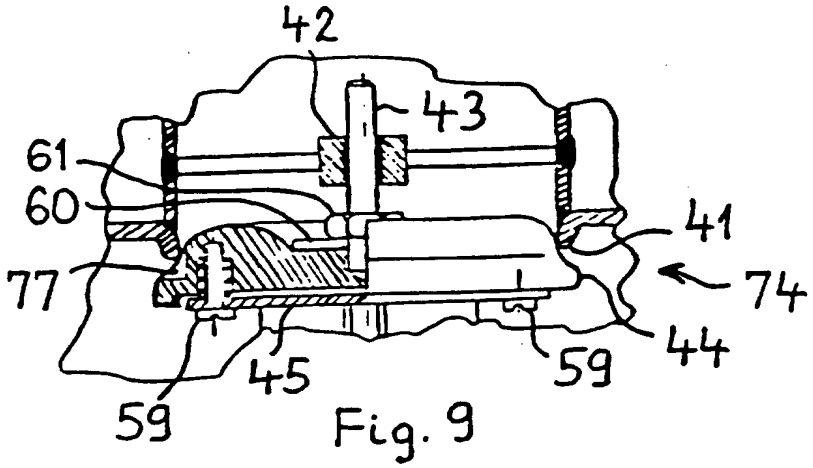


Fig. 9

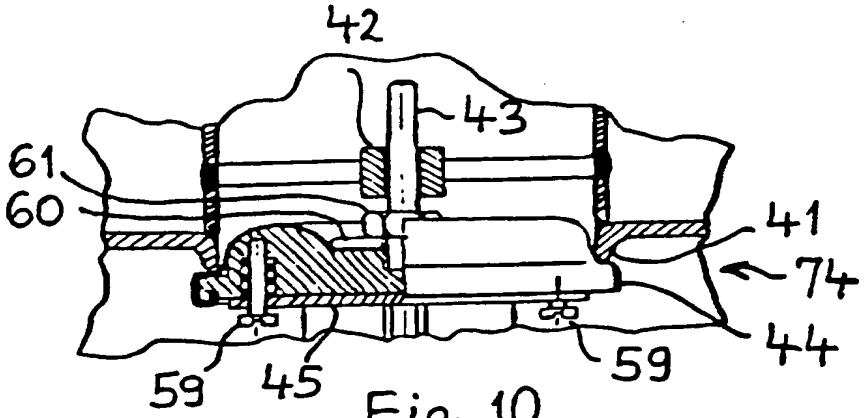


Fig. 10

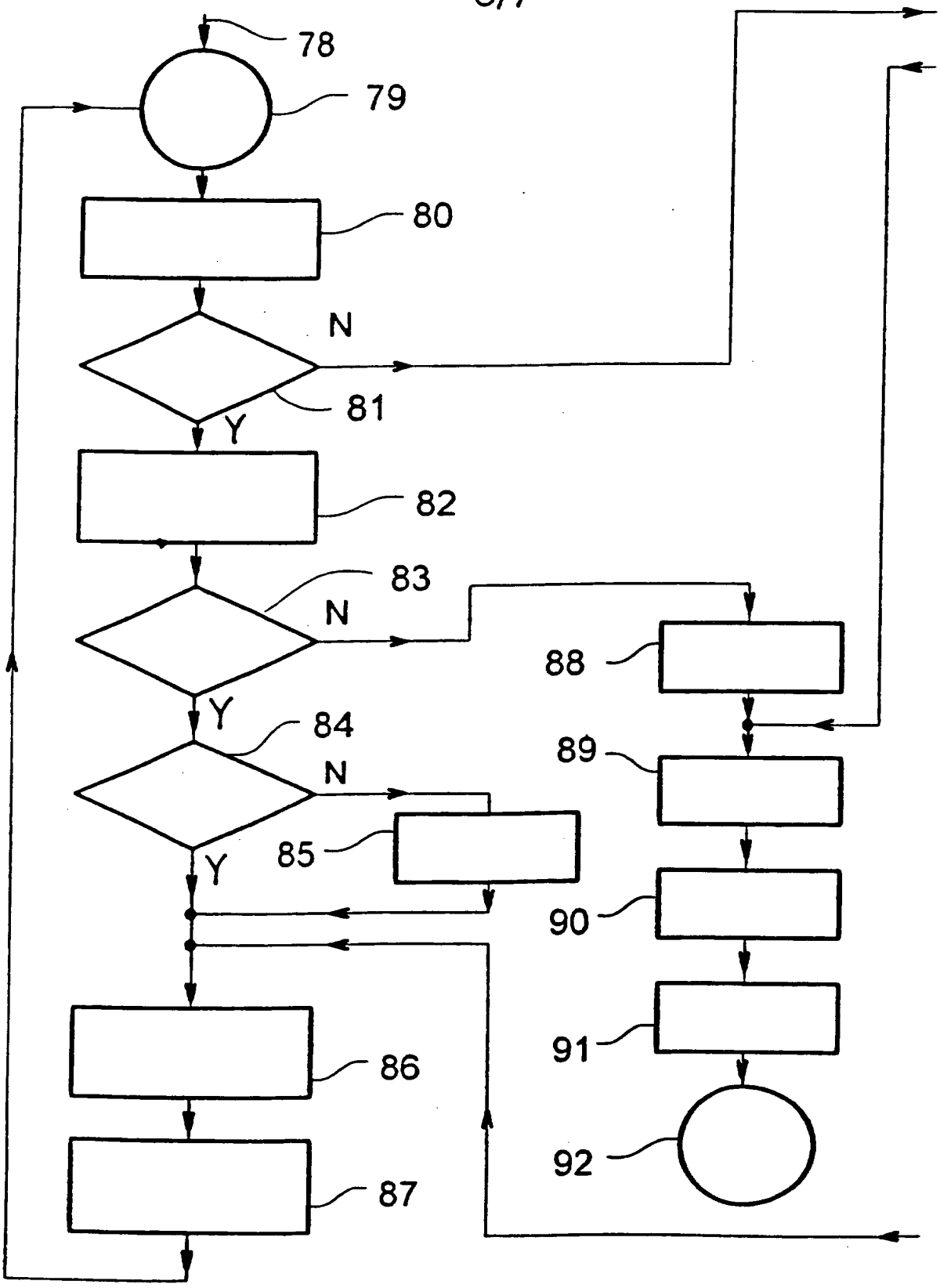


Fig. 12A

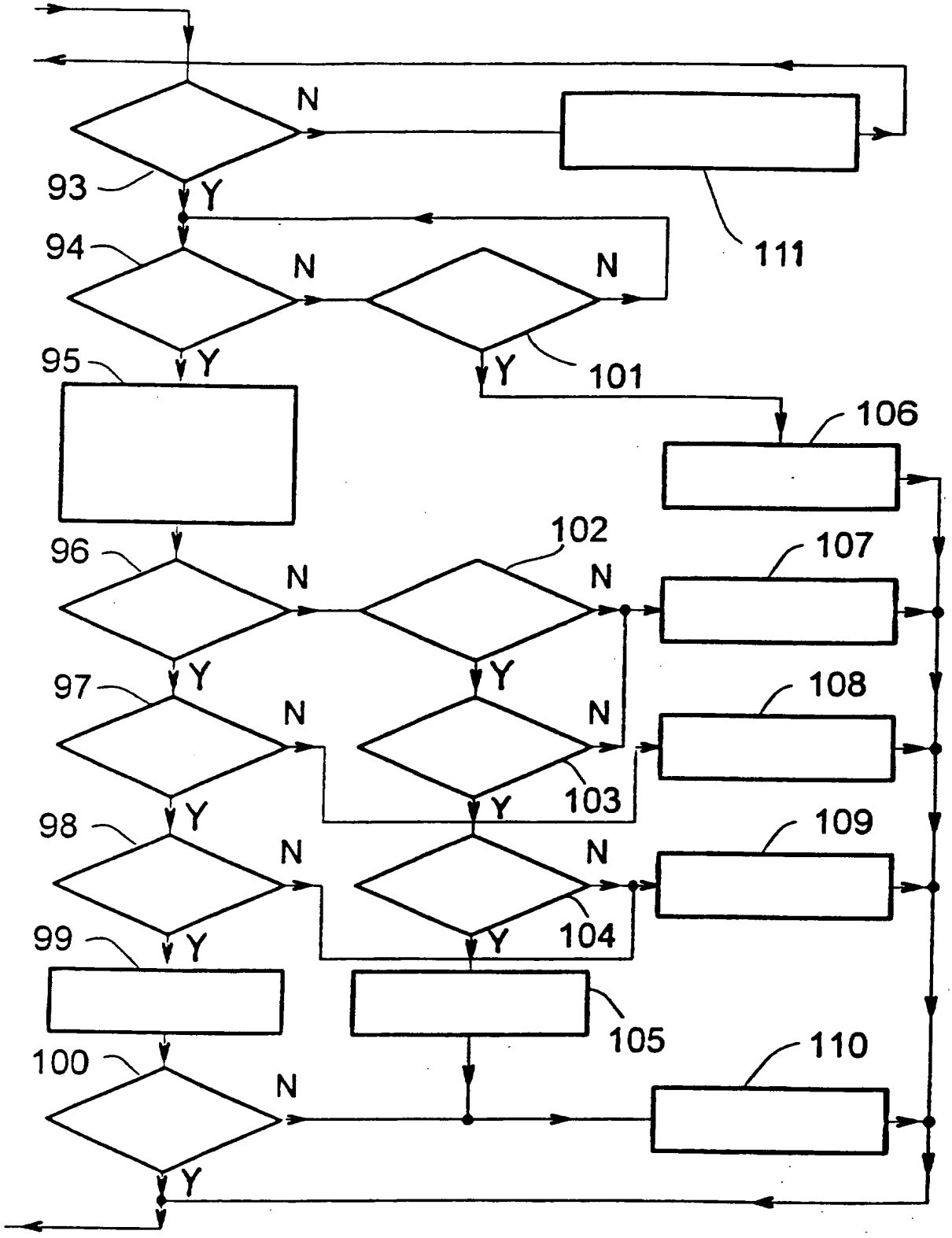


Fig. 12B

INTERNATIONAL SEARCH REPORT

Intern. nal Application No
PCT/HU 95/00037

A. CLASSIFICATION OF SUBJECT MATTER

G 07 F 15/06

According to International Patent Classification (IPC) or to both national classification and IPC 6

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G 07 F,F 02 D,B 67 D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP, A, 0 063 893 (MAINMET LIMITED) 03 November 1982 (03.11.82), claim 10; page 7, lines 4-12 (especially lines 11,12); fig. 1.	1
A	--	6-11
Y	US, A, 5 311 849 (LAMBERT et al.) 17 May 1995 (17.05.95), column 5, lines 20-24; column 6, lines 10-16; fig. 1,7.	1
A	--	5
A	DE, A, 2 046 211 (FISPER) 15 April 1971 (15.04.71),	1

[X] Further documents are listed in the continuation of box C.

[ ] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search
27 November 1995

Date of mailing of the international search report
21. 12. 95

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+ 31-70) 340-3016

Authorized officer
BISTRICH e.h.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Interna..al Application No
PCT/HU 95/00037

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	claims 1,2,6; fig. 1,2.	
A	GB, A, 470 759 (THE AIR LOG COMPANY LIMITED) 17 August 1937 (17.08.37), claim 1; fig. 8.	2,3
A	US, A, 4 630 754 (KOMUKAI) 23 December 1986 (23.12.86), column 7, lines 18,19; fig. 7,8(a).	12,13
A	DE, A, 3 102 018 (LGZ LANDIS & GYR ZUG AG) 24 June 1982 (24.06.82), claim 10.	14

ANHANG — ANNEX — ANNEXE

zum internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

to the International Search Report to the International Patent Application No.

au rapport de recherche international relatif à la demande de brevet international n°

PCT/HU 95/00037 SAE 115102

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The Office is in no way liable for these particulars which are given merely for the purpose of information.

La présente annexe indique les membres de la famille de brevets relatifs aux documents de brevets cités dans le rapport de recherche international visée ci-dessus. Les renseignements fournis sont donnés à titre indicatif et n'engagent pas la responsabilité de l'Office.

Im Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
EP A2 63893	03-11-82	AT E 35469 DE C0 3278727 EP A2 63893 EP B1 63893	15-07-88 04-08-88 01-12-82 29-06-88
US A 5311849	17-05-94	EP A1 650555 WO A1 9401667	03-05-95 20-01-94
DE A1 2046211		CH A 495594 DE A 2046211 DE B2 2046211 DE C3 2046211 GB A 1280916 US A 3670924	31-08-70 15-04-71 14-11-74 26-06-75 12-07-72 20-06-72
GB A 470759		keine - none - rien	
US A 4630754	23-12-86	JP A2 60251090 JP B4 5030715 KR B1 8701723 JP A2 60090196 JP B4 3046396 JP A2 60090194	11-12-85 10-05-93 25-09-87 21-05-85 16-07-91 21-05-85
DE A1 3102018	24-06-82	CH A 657465 GB A1 2089548 GB B2 2089548	29-08-86 23-06-82 05-09-84